Utilization of video conferencing

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Stressing the importance of accumulating systematic empirical information on the users and uses of video teleconferencing, the authors present the findings of a pilot study of AT&T's Picturephone Meeting Service. They then set out preliminary conclusions that may be drawn from those findings. The authors suggest that video telecommunication is likely to be beneficial to decision making processes in modern organizations.

Keywords: Teleconferencing; Video communications; Business communications

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Several trends suggest that the use of video telecommunication technologies is likely to expand significantly over the next decade. In particular, travel costs are increasing very rapidly in relation to telecommunication costs. Moreover, the technical quality and feasibility of video telecommunications is continuing to improve with advances in communication satellites, video compression techniques, and more experience with systems now in use. Already, several large organizations are embarking on the development of in-house systems. Other organizations are considering the use of publicly available systems.

As the use of video telecommunications becomes more widespread, existing research on the relative efficacy of video as compared to other forms of communication is gaining increasing importance. One of the more important findings on the social psychology of teleconferencing is that, for many communication tasks, audio and video telecommunication technologies are no more effective and sometimes less effective than audio-only communications – yet far less economical.[1] Other research has centred on the so-called 'telecommunications–transportation tradeoff' – the notion that video teleconferencing may provide organizations with a viable, cost-effective substitute to having individuals travel for face-to-face meetings. Despite the attractiveness of this rationale, the few existing cost studies have not demonstrated that video teleconferencing actually is substituted for travel.[2] Refinement and extension of these research trials are obviously central to future research on telecommunications.

At the same time, new and more basic issues arise surrounding the effects of video telecommunication utilization on the organizations that employ the technology. Prominent among these issues are the effects of video teleconferencing on the relative influence of various participants in organizational decision making.[3] In geographically dispersed firms, for example, will the utilization of video systems increase centralization by facilitating central management's substantive participation in a greater range of branch management decisions? Alternatively, will branch managers acquire greater influence via video participation in a greater variety of central management decisions?

Such important issues have generated much speculation, but little research, on video teleconferencing users and uses. In fact, little is really known even now about who utilizes video teleconferencing systems for what purposes and with what effects. Yet, elemental knowledge of teleconferencing users and uses is a critical building block for design of

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research on teleconferencing which will be of substantive value to developers of new communication technologies, potential adopters in the public and private sector, and state and federal government officials charged with facilitating the development of socially and economically effective communication systems. Without such knowledge, continued reliance is placed on prevalent but untested assumptions, such as that video teleconferencing is an elitist medium (ie primarily employed by only the elite of the corporate world). Systematic empirical information can provide more reliable grounds for views of video conferencing. The development of such information obviously must occur over time and across a variety of studies. The research findings reported here represent one step in the accumulation of such important data. In the following pages, we present preliminary information on video conferencing users and uses that is derived from a pilot study of one publicly available system – AT&T's Picturephone Meeting Service (PMS) – during its market trial period. PMS facilities were selected because they were one of the few simultaneous, full-motion, two-way video and audio conferencing sytems in use at that time.

Survey of PMS users

At the time of our pilot study in May 1981 PMS facilities were located in twelve US cities, varying somewhat in their networking and video capabilities. PMS facilities in three Californian cities (Los Angeles, Sacramento, and San Francisco) were sampled from the twelve on the basis of their proximity to USC, and their location in the jurisdiction of a single operating company, Pacific Telephone and Telegraph Company.

Questionnaire packets were sent to the PMS room attendants in Los Angeles, Sacramento, and Los Angeles. Each packet included a project cover letter, a self-administered questionnaire, and a return envelope. AT&T managers also attached a cover letter explaining the independence of this project from Pacific Telephone and AT&T. PMS room attendants were asked to distribute one questionnaire to each meeting participant at the end of each meeting over a three-week period ending on 10 June 1981, the date at which the PMS marketing test period ended.[4] Because our research staff were not on site, questionnaires were numbered sequentially to permit both an estimate of response rates and the grouping of questionnaires by conference. Questionnaires were completed anonymously, except that those respondents interested in obtaining a report of findings voluntarily provided name and address.

This administration procedure yielded a response rate of 53% (see Table 1 for the estimated number of questionnaires distributed and actual returns by site). Follow-ups to non-respondents were impossible given the anonymity of the questionnaire and of each PMS customer. Despite this, the response rate is higher than many mail surveys with extensive follow-ups.

[1]Robert Johansen, Jacques Vallee and Kathleen Spangler, *Electronic Meetings: Technical Alternatives and Social Choices*, Addison-Wesley, Menlo Park, CA, 1979; Roger Pye and Ederyn Williams, 'Teleconferencing: is video valuable or is audio adequate', *Telecommunications Policy*, Vol 1, No 3, June 1977, pp 230–241; John Short, Ederyn Williams and Bruce Christie, *The Social Psychology of Telecommunications*, John Wiley and Sons, New York, 1976.

[2]Martin C.J. Elton, *Videoconferencing: Some Reflections of Recent Research*, Alternate Media Center, School of Arts, New York University (mimeo); Richard Chandler Harkness, *Telecommunications Substitutes for Travel*, (Xerox) University Microfilms, Ann Arbor, MI, 1973; Kenneth L. Kraemer, 'Telecommunications/transportation substitution and energy conservation – Part 1', *Telecommunications Policy*, Vol 6, No 1, March 1982, pp 39–59; Jack M. Nilles and F. Roy Carlson, Jr, Paul Gray, Gerhard J. Hanneman, *The Telecommunications-Transportation Tradeoff*, John Wiley and Sons, New York, 1976.

[3]Day Kohl, P.G. Newman and J.F. Tomey, 'Facilitating organization decentralization through teleconferencing', *IEEE Transactions on Communications*, COM 23(10), pp 1098–1104.

[4]This was an AT&T market trial authorized by FCC Tariff 263.

Table 1. Questionnaire distribution, return, and response rates.[a]

Site	Number distributed (estimated)	Number returned (actual)	Response rate (%)
Los Angeles	31	17	55
Sacramento	66	36	54
San Francisco	34	16	47
Total	131	69	53

[a]In some cases, it is apparent that questionnaires were not handed out in sequence. Therefore, these figures are estimates based on averaging site response rates over questionnaires that were distributed in sequence. Also, we cannot verify that all users were handed a questionnaire as intended.

Users of video conferencing

One major purpose of our survey was to examine variation across users of video teleconferencing. On the one hand, a finding of little diversity across users of a publicly available facility with artificially low rates could have important short-term implications of relevance to policy makers interested in the broad availability of telecommunications services.[5] On the other hand, a finding of substantial diversity would have rather different implications. First of all, a diversity of users would support a position contrary to the lingering stereotype that advanced communication media are 'elite technologies', basically employed by the largest and wealthiest private corporations – the Fortune 500 companies, the largest banks, and insurance companies.[6] Second, substantial diversity would suggest to policy makers that, at least potentially, the technology could be adopted to broader popular utilization. Our survey was designed to measure diversity both within and across organizations represented in the survey. Interorganizational diversity was assessed by variation among users in industry type, organization size, geographical dispersion of the organization, and profit versus non-profit status.

Profit versus non-profit status

Both profit and non-profit sectors were heavily represented in the sample. Included were major Fortune 500 companies as well as little-known private companies; major governmental users were sampled, as well as private, non-profit organizations. In all, one-half of our respondents were from profit-making organizations, and one-half were from non-profit organizations (see Table 2). The strong non-profit presence is striking, and is probably explained, in part, by our sampling from a video conferencing facility located in a major government seat (Sacramento), and Government Brown's promotion of telecommunication alternatives to transportation. Also, some governmental uses such as Board of Control Hearings resulted in relatively more individuals being involved in a given meeting.[7] Nevertheless, public and private, not-for-profit sector participation was substantial, indicating considerable diversity on the profit versus non-profit status criterion.

The generalizability of the strong public/non-profit presence to other more costly video conferencing services is unknown. In general, the unique nature of public accountability in the public sector might make continued use of video conferencing at least partly dependent upon clear demonstration of cost effectiveness – via travel substitution or other evaluative criteria. Once rates are no longer artificially low, the burden to demonstrate cost-effectivenes will undoubtedly be heavier. At the same time, it is clear from the strong public sector utilization that the medium has been adapted to some rather important public sector needs, such as hearings. The potential of video teleconferencing to assist public as well as private organizations seems quite apparent. Future research might profitably be directed towards assessing the impact that the medium has upon the manner in which these public service applications are met.[8]

[5]PMS rates were below cost for the trial period during which the survey was conducted.

[6]Kenneth C. Laudon, *Communications Technology and Democratic Participation*, Praeger, New York, 1977; Herbert I. Schiller, *Who Knows: Information in the Age of the Fortune 500*, Ablex, Norwood, NJ, 1981.

[7]Only 38% of the *meetings* sampled were conducted by public and/or non-profit organizations.

[8]For example, research underway by Coulombe compares outcomes of face-to-face versus video-conferenced hearings (Joseph Coulombe, 'The use of video conferencing for public hearings', forthcoming in Loren Parker, ed, *Teleconferencing and Interactive Media*, University of Wisconsin-Extension, Madison, WI, 1982).

Table 2. Government v private industry representation.

Kind of organization	Percentage of users (N)	Percentage of conferences (N)
Government/non-profit[a]	51(35)	38(10)
Private industry	49(34)	62(16)

[a]This category includes local and state government agencies, and voluntary organizations.

Industry type

Table 3 shows the distribution of respondents by industry. Almost half the public sector users are from health services; nearly one-third of private sectors respondents are from telecommunications industries. Thus, there was some concentration of users in these two categories. However, usage was far from limited to these two industry groups. In fact, Table 3 shows a considerable range of industry users. Represented are manufacturing and service subsectors, including some industries not typically considered 'high technology'. Among these are corporations, partnerships, voluntary associations and commonwealth organizations. In part, this range reflects the use of video conferencing for a variety of interorganizational functions in contrast to its use simply for intracompany communication. One illustrative case is the use of video conferencing by a professional association for conference planning. Such conferences bring a diverse array of organizations from the public and private sector around the same tables.

Within the private sector alone, the largest concentration of users – telecommunications and insurance – is consistent with stereotypic expectations. At the same time, however, the diversity of industries represented suggests that the needs addressed via teleconferencing are not industry-specific nor sector-specific. In fact, the data suggest that the medium is suited to fairly universal communication needs, although perhaps certain industries have taken advantage of the medium's abilities to a greater degree than have other industries.

Organization size

Video conferencing usage was not limited to large corporations. Our survey findings suggest that organizations of varying sizes used PMS video conferencing during the focal period, although larger organizations were heavily represented. Figure 1 shows the percentage of respondents employed by organizations of varying sizes. Almost one-third (31%) of the respondents represented organizations employing fewer than 100 people. Still, over one-half of the respondents are employed by

Table 3. Industries represented in sample.[a]

	Percentage (N) of respondents
Government/non-profit	
Health services	23(16)
Transportation/motor vehicle	10(7)
Energy regulation	6(4)
Water resources	3(2)
Board of control	3(2)
Education	3(2)
Law enforcement	1(1)
General services	1(1)
Private industries	
Telecommunications	16(11)
Insurance	7(5)
Professional association	6(4)
R&D, defence related	4(3)
Manufacturing/distribution of assorted products	4(3)
High technology conglomerates	3(2)
Management consulting	1(1)
Retailing	1(1)
Financial	1(1)
Building products and manufacturing	1(1)
Engineering and construction	1(1)
Publishing	1(1)
Total	100(69)

[a]Respondents were asked: 'In what industry classification would you categorize your company/agency's primary activities?'

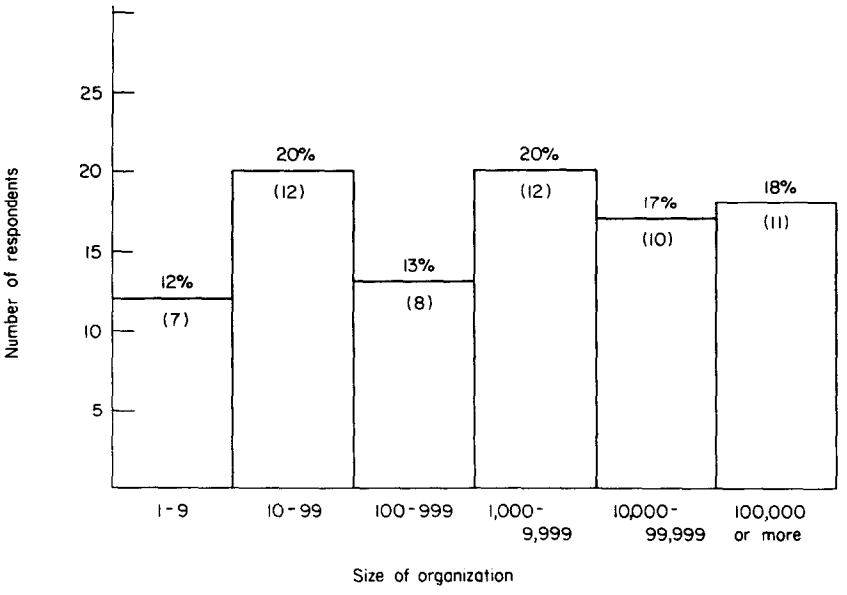

Figure 1. Size of organizations using video teleconferencing.

Note: Respondents were asked: 'Approximately how many people are employed by your company/agency?'; Mean = 28 438, N = 60.

organizations of over 1000 people. The fact that PMS was a publicly available system might have influenced the distribution of respondents. Larger organizations are undoubtedly more overrepresented among organizations employing 'in-house' systems.

Respondents were also asked to rate the size of their organization relative to other organizations in their primary industry. Table 4 shows that the distribution of responses was skewed towards the high-end of the scale. Over one-half (54%) of the respondents rated their organization as 'very large' and almost three-fourths (72%) rated their organization either 'large' or 'very large' in comparison with other organizations in their primary industry.

The disproportionate use of public video conferencing facilities by larger organizations might even be understated by our data, for two reasons. First, larger organizations are more frequent purchasers of the few 'in house' systems that exist, which reduces the need for using public facilities. Second, during the trial, the hourly charge for the use of video conferencing was kept below its actual cost. Because the accessibility of video conferencing is likely to be sensitive to rate structures, use by smaller organizations might be relatively high during this trial period.

Despite this clear and interesting pattern of findings, it should be noted that our size criterion was limited to the relative and absolute number of individuals employed by the organizations represented in the sample. Such measures of size are important indicators of the likely need for telecommunication services. Other size criteria need to be investigated as well. It might be, for example, that revenues, assets, and/or other resources are more important correlates of the utilization of telecommunications. Future research might profitably track utilization patterns in relation to specific economic criteria of organization size.

Overall, our survey findings suggest utilization of video conferencing by organizations across a wide range of size categories, although large organizations clearly tend to predominate. Again, it appears that video conferencing has properties which appeal to a broad spectrum of organizations, although most frequent usage is indeed among a smaller segment of individuals from reasonably large organizations.

Table 4. Size of organization relative to others in primary industry[a]

	Percentage (N)
Small	18(10)
Medium	12(7)
Large	18(10)
Very large	53(30)
Total	100(57)

[a]Respondents were asked: 'How large is your organization (company) compared to other organizations in your primary industry?'

Table 5. Geographical location of facilities and offices.[a]

	Percentage (N)
Local	18(12)
In-state regional	4(3)
Statewide	47(31)
Multistate regional	4(3)
National	11(7)
Multinational	15(10)
Total	99(66)

[a]Respondents were asked: 'Which of the following describes the geographical location of the facilities and offices owned or operated by your company/agency?'

Geographical dispersion

The geographical composition of organizations using video conferencing is more in line with conventional stereotypes. That is, organizations with geographically dispersed facilities are considered to have a greater need for cross-locational communication tools. For example, one study of managerial attitudes towards a new video conferencing system found projected video conferencing usage to be related to managers' desires for greater interaction with other locations.[9] Table 5 shows the geographical dispersion of the organizations represented by our respondents. Over 80% indicated that facilities and offices operated by their organization were dispersed beyond any single local area. The largest category of geographical distribution is statewide, due to use by agencies and departments of the state of California. Yet, as with the other factors, there is still considerable variation in geographical dispersion of company facilities across respondents.

Interestingly, the amount of geographical dispersion of a respondent's employing organization appeared to be related to use of the medium for intercompany versus intracompany communication. Usage of video teleconferencing for meeting with members of *other* companies was reported by 47% of respondents from organizations with high geographical dispersion, compared to 87% of respondents from organizations with low geographical dispersion.[10] Clearly conferencing was a link to the outside environment for both types of organizations. Additionally, geographically decentralized firms made more substantial use of the medium for intracompany communications. Geographically dispersed firms were able to employ the technology to meet a more diverse set of communication needs. Once again, the flexibility of video conferencing is highlighted by its substantive use for communicating both within and across organizations – particularly for geographically dispersed organizations.

In summary, perhaps the most pertinent generalization is that there was considerable diversity across organizations in the utilization of video conferencing, along with a concentration in a subset of larger organizations and the telecommunications industry. At least potentially, the medium appears to have considerable applicability to a variety of communication needs across a range of public and private organizations. At the same time, certain segments of organizations appear to have taken advantage of its capabilities to a greater degree than have other segments.

Conference participants

The impact of video conferencing on decision making (and a variety of other organizational processes that incorporate substantial interpersonal communication) will depend on the nature of users and their positioning within the organization. For example, the likelihood of the medium substantially affecting organizational policy decisions will be enhanced when key organizational policy makers are important users. Similarly, the probability that video conferencing will enhance the power of boundary-spanning individuals or units such as marketing, purchasing, and research and development via increased control over information channels to the outside environment depends upon its utilization by boundary personnel.[11] Logically, the more extensive and diverse the use of video conferencing, the greater is the likelihood that the medium will affect important organizational decision processes. Our survey was

[9]Lynne Svenning and John Ruchinskas, 'Predicting receptivity and resistance to video conferencing', paper presented at the International Communication Association, Minneapolis, MN, 1981.

[10]Organizations with facilities distributed statewide, multistate, national or multinational, were considered to be highly dispersed. Organizations that are local or regionally distributed within a state were considered to have low dispersion.

[11]For a discussion of boundary and core personnel, see James B. Thompson, *Organizations in Action*, McGraw-Hill, New York, 1967.

Table 6. Respondent's level in the organization.[a]

	Percentage (N)
Top executive officer or related staff	15(10)
Upper management or related staff	21(14)
Middle management or related staff	35(24)
Lower-level management or related staff	16(11)
Other[b]	13(9)
Total	100(68)

[a]Respondents were asked: 'What is your level within your company/agency?'; [b]Other responses included: board member, attorney, professor, trainee, volunteer.

Table 7. Divisions/departments of respondents.[a]

	Percentage (N)
Marketing/sales	12(8)
General management	12(8)
Program/project management	10(7)
Legal	8(5)
Personnel	6(4)
Planning	3(2)
Finance	5(3)
Research	5(3)
Design/development	5(3)
Accounting	3(2)
Production	3(2)
Other[b]	30(20)
Total	100(67)

[a]Respondents were asked: 'In what division or department do you work?'; [b]Other responses included: Computer, standards, energy conservation, instruction, procurement, mass transportation, clerical, engineering, training, editorial.

designed to tap a diversity of organizational users on the basis of three factors: hierarchical level, functional area, and unit size.

Hierarchical level. An expectation of dominant usage of video conferencing by top management derives from the 'substitution paradigm' that has guided much of teleconferencing research.[12] A first step for many researchers in predicting who would be most likely to teleconference is to derive estimates from existing travel frequency.[13] In studies of travel patterns, a frequent finding is that top management has the heaviest travel load and the desire to travel is inversely related to travel frequency.[14] Therefore, the reasoning goes, top management should be more favourable to telecommunications alternatives to travel. However, in these and other studies of attitudes towards the use of teleconferencing as a substitute for travel, the desire to decrease the number of trips taken did not significantly relate to the choice to teleconference.[15]

Table 6 presents the distribution of respondents to our survey by hierarchical level within their organization. Middle and lower level managers and staff comprised a larger proportion – over half – of the users. Video conferencing is not only a top executive privilege or 'toy'. Still, a disproportionate number of respondents (one-third) were from top management ranks. The appeal of video conferencing to important organizational policy makers is apparent. Aso, the medium appears suited to the needs of lower-level organizational participants as well.

Functional area and unit size. Video conferencing users spanned a variety of departments and divisions within their organizations. As shown in Table 7, the most frequently found users were from boundary-spanning units like marketing/sales, and management, including general management and programme/project management. A wide variety of other departments both in boundary and non-boundary positions were also users. Table 8 shows the percentage of respondents from organizational units of different sizes. While nearly one-half of the respondents described their units as medium-sized, small and large units were well represented. Only 3% of respondents described their units as 'very large'.

Overall, the patterns of intraorganizational positions of users suggest considerable diversity, with some overrepresentation from the upper ranks. Again, the pattern suggests the flexibility of the video teleconferencing medium in meeting the needs of a variety of segments within organizations.

Uses of video conferencing

Knowing who uses video conferencing is one important piece in putting together the broader puzzle of how video conferencing is used. To explore the uses of video conferencing further, the survey went beyond the characteristics of users and sought to identify three clusters of factors pertaining to usage: participant roles and experience with the medium, the nature of the linkages across nodes, and the kinds of communication activities for which interactive video was used.

Participant roles and experience with the medium

The roles of participants in a video conference could range from that of a

[12]Harkness, *op cit*, Ref 2; Richard Chandler Harkness, *Technology Assessment of Telecommunications/Transportation Interactions*, Vols I and II, Stanford Research Institute, Menlo Park, CA, 1977; Roger Pye, Michael Tyler and B. Cartwright, 'Telecommunicate or travel', *New Scientist*, Vol 63, No 514, 1974, pp 641–644; J.H Kollen and J. Garwood, *Travel/ Telecommunications Tradeoff: The Potential for Substitution Among Business Travelers*, Bell Canada, Montreal, 1975; Nilles *et al, op cit*, Ref 2; Roger Pye, B. Cartwright and Hugh Collins, 'Prospects for Teleconferencing', *Intelligence Bulletin*, Long Range Studies Division, Post Office Telecommunications, Cambridge, 1977; Michael Tyler, Martin Elton, and A. Cook, *The Contribution of Telecommunications to the Conservation of Energy Resources*, OT Special Publication 77–17, Office of Telecommunications, US Department of Commerce, Washington, DC, 1977; Kraemer, *op cit*, Ref 2.

[13]For example, Ronald Westrum, *Communication Systems and Social Change*, PhD dissertation, University of Chicago, IL, 1972.

[14]*Ibid*; Kollen and Garwood, *op cit*, Ref 12.

Table 8. Size of department relative to others in organization.[a]

	Percentage (N)
Small	26(15)
Medium	47(27)
Large	24(14)
Very large	3(2)
Total	100(58)

[a]Respondents were asked: 'How large is your division/department compared to others in your organization?'

Table 9. Participant's primary role in the video teleconference.[a]

Primary role	Percentage (N)
Discussant (took part in discussion)	54(37)
Staff (assisted meeting participants)	17(12)
Speaker (made a presentation to others)	14(10)
Listener (primarily listened to others)	14(10)
Total	100(69)

[a]Respondents were asked: 'What was your *primary* role in the meeting that just took place?'

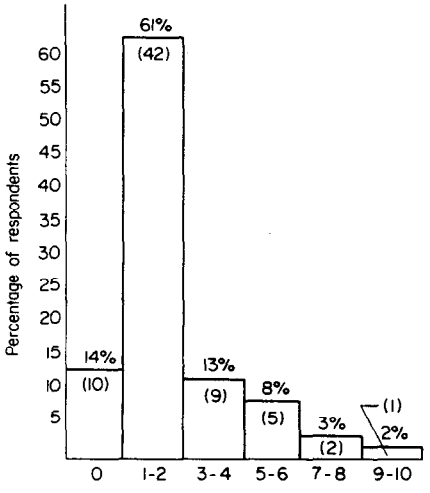

Figure 2. Number of previous video teleconferences.
Note: Respondents were asked: 'How many times have you video conferenced over the last six months?'; Mean = 2.0; Frequency in parentheses.

[15]Elliot Gold, 'Attitudes to intercity travel substitution', *Telecommunications Policy*, Vol 3, No 2, June 1979, pp 88–104; Svenning and Ruchinskas, *op cit*, Ref 9.
[16]Westrum, *op cit*, Ref 13; Kollen and Garwood, *op cit*, Ref 12; Kraemer, *op cit*, Ref 2; Gold, *op cit*, Ref 15; Svenning and Ruchinskas, *op cit*, Ref 9.
[17]For example, Elton, *op cit*, Ref 2; Gold, *op cit*, Ref 15; Svenning and Ruchinskas, *op cit*, Ref 9.

speaker, to a discussant, to staff, to simply a listener. Respondents were asked to indicate their primary role in the conference they attended. As shown in Table 9, most participants (54%) felt they played the role of discussant. Relatively few participated in a passive manner as primarily listener,or in a very active manner as primarily presenter. Given the unique features of video conferencing as a two-way interactive medium, it is not surprising that the discussant's role is so common and that discussion is a primary activity.

Regular use of the medium as a communication tool for meetings was not apparent for our sample. Most respondents (61%) had only used video conferencing occasionally – once or twice over six months (Figure 2), and for less than two hours (Figure 3). Although most respondents had some limited experience with video conferencing (only 15% had never video conferenced before the survey), the tendency was towards infrequent usage. In part, this may reflect the fact that the survey sampled users of a publicly available facility – convenient in-house systems might be a more common vehicle where frequent usage is required. At the same time, however, the occasional usage patterns described here are not really conducive to a continuing impact of video conferencing on organizational processes. Also, the importance and/or breadth of the communication needs that are met by the medium is difficult to discern. Infrequent usage might suggest that video teleconferencing was not perceived as an effective and/or cost-justified means of meeting many communication needs. Alternatively, it could reflect simply trial usage characteristics, the early stages of adoption of an innovation, and/or unfamiliarity with the capabilities of the service. Future, in-depth attitudinal studies might shed light on these alternative interpretations.

The usage frequencies that respondents reported for their *organizations* project a picture of slightly more substantial usage. Table 10 shows that although no one reported regular use of the technology by many units, 23% reported regular use by a few units. Still, however, 54% reported only rare or occasional use.

Finally, the telecommunications–transportation trade-off perspective views video conferencing as a mechanism for substituting telecommunications for travel, allowing people to teleconference instead of personally attend. However, this view typically has not been supported in either attitudinal or operational studies of teleconferencing systems.[16] An alternative perspective is that telecommunications may remove constraints to meeting participation that arise due to geographical barriers.[17] That is, telecommunications may augment or enhance meetings in one of two ways. First, meetings might be held that would not otherwise have occurred due to geographical separation of participants. Second, meetings might include individuals who otherwise might not have participated due to time, cost, or other restrictions that travel for person-to-person meetings would face. Respondents to our survey were asked whether video conferencing permitted them to attend meetings that they otherwise would not have attended. The survey data support the meeting enhancement or augmentation perspective. As Table 11 shows, over 60% of the respondents reported participation in meetings in which they would not otherwise have been involved.

The augmentation potential created by the utilization of video teleconferencing has a number of interesting implications. It suggests that in calculating cost effectiveness, travel substitution is only part of the equation. The benefits of having more relevant parties involved needs to

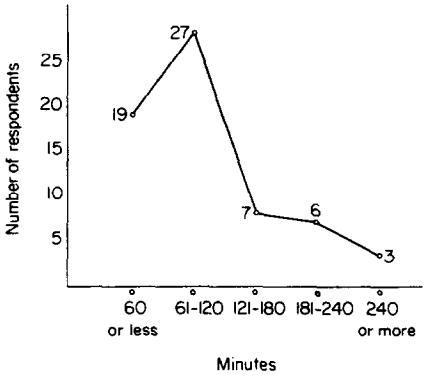

Figure 3. Average length of video teleconferences.
Note: Respondents were asked: 'On the average, how long do these video conferences last?'; Mean = 112 minutes.

Table 10. Frequency of video conference use by organizations.[a]

	Percentage (N)
Rarely used	28(19)
Occasionally used	26(18)
Used regularly by a few divisions/departments	23(16)
Used regularly by many divisions/departments	0(0)
Don't know	19(13)
Total	100(66)

[a]Respondents were asked: 'Overall, how frequently is video conferencing used by your company/agency?'

Table 11. Percentage attending meetings who otherwise could not have attended.[a]

	Percentage (N)
Yes, would otherwise not have attended	61(40)
No, would have attended anyway	39(26)

[a]Respondents were asked: 'Overall, has the use of video conferencing permitted you to participate in meetings that you would otherwise not have attended?'

be included in the effectiveness side of the equation. The contribution to decisional and/or meeting effectiveness of including individuals with different, unique contributions is well documented[18] although quantification may be difficult. To the extent that a meeting is augmented with participants who bring unique expertise rather than redundant perspectives, the quality of the meeting's product can be enhanced. Also well documented is the conclusion that individuals will be more committed to decisions in which they have participated.[19] Thus, video conferencing might be employed to develop commitment to the successful implementation of organizational decisions.

At the same time, once the composition of the group is altered by inclusion of other individuals, the processes and products of meetings may be altered dramatically in both functional and dysfunctional ways, as coalitions shift, group process management demands increase, different information input is included, etc. In fact, the inclusion of individuals outside the 'inner circle' (ie those who would have attended the meeting anyway) might even lead to suppression of important decision making. In other words, the 'insiders' might shift the locus of decision making to outside the meeting. Clearly, a variety of issues attendant upon change in group composition via video participation are worthy of research activity.

Another factor related to the effectiveness side of the cost/benefit equation pertains to the advantages of two-way, interactive communication over one-way and/or two-way asynchronous links for communication accuracy. The employment of an interactive meeting rather than exchange of written messages, for example, may facilitate accurate communication. Thus, where video teleconferencing allows an interactive meeting to occur that would not have occurred otherwise, effective communication may be enhanced. This may, of course, depend upon the availability of necessary peripherals for document transmission and the like, in the video conferencing package.

Also, where public accountability for decisions is high (especially in the public sector), availability of the meeting to a greater number of constituencies can be desirable. And, finally, the increased number of participants in meetings can provide a vehicle for justification of expenditures on the medium.

Overall, the change in number and nature of meeting participants might well be one of the more important factors that can be considered in the decision to teleconference.

Nature of linkages across nodes

Thus far, our analysis has focused primarily on participants at the meeting sites that were sampled in our research. To obtain a broader picture, respondents were asked to describe the individuals with whom their group teleconferenced. The responses are summarized in Table 12. Interestingly, most links involved horizontal rather than vertical (superior–subordinate) communication. Most respondents (62%) were linked with individuals from *other* companies and agencies. The next most frequent channel involved individuals at one's own level within the respondent's company or agency (45%). Diagonal links were reported by 31% of the respondents (18% to other superiors and 13% to other subordinates). Less than 20% of the respondents reported vertical communication links (13% to their immediate superiors and 5% to their immediate subordinates). This might reflect the fact that superiors and subordinates are more likely to be physically proximate and will thus

[18]A.P. Hare, *Handbook of Small Group Research*, 2 ed, Free Press, New York, 1976.
[19]Victor Vroom and Phillip Yetton, *Leadership and Decision-Making*, University of Pittsburgh Press, Pittsburgh, PA, 1974.

Table 12. Other participants in the video teleconference.[a]

	Present at other end, % (N)	Not present at other end, % (N)	Not applicable, % (N)	Total, % (N)
Individuals in other companies/agencies	62(38)	15(9)	23(14)	100(61)
Individuals at your level within the company/ agency	45(29)	24(15)	31(20)	100(64)
Other superiors in your company/agency (besides immediate superior)	18(11)	34(21)	48(29)	100(61)
Your immediate superior(s)	13(8)	38(23)	49(30)	100(61)
Individuals at lower levels in your company who are not your immediate sub-ordinates	13(8)	40(24)	47(28)	100(60)
Your immediate sub-ordinates	5(3)	41(24)	54(32)	100(59)

[a]Respondents were asked: 'Who did you video conference with (who was at the other end)?'

engage primarily in face-to-face interactions. It also suggests the role that video conferencing may play as an integrating mechanism and as a means to reduce vertical information flow and consequent managerial overload. Direct horizontal or diagonal contact among units whose activities require coordination obviates the necessity of referring many joint problems upward until they reach a common superior for coordination and control.[20]

As a supplementary analysis, responses were clustered by meeting; the number of meetings in which each type of linkage was reported was tabulated for public and private sector meetings separately and for the two combined. These findings are presented in Table 13. From a total meeting standpoint, the most frequent linkage encountered was interorganizational (69%). While this was true for both private (56%) and public (90%) meetings, the latter tended to be more interorganizational. Clearly, video teleconferencing was employed as a link from the organization to its environment. Intraorganizational communication links were substantial and reasonably similar in frequency for both sectors. Meetings involving diagonal linkages were most common, particularly in the private (62%) as opposed to the public (50%) sector. Thus, the significance of diagonal links is more apparent when their presence, rather than the absolute number of links (per Table 12), is the criterion. Horizontal channels were present in as many meetings in the public sector (50%), although in somewhat fewer meetings in the private sector (44%). In combination, the integrating functions of horizontal and diagonal links and their implications for

[20]Jay Galbraith, *Organization Design*, Addison-Wesley, Menlo Park, CA, 1977.

Table 13. Number and percentage of meetings in which other participants were present at the other end of the link.

Other participants	Public sector % (N)	Private sector % (N)	Total % (N)
Individuals from different companies/agencies	90(9)	56(9)	69(18)
Individuals at same level within company/agency	50(5)	44(3)	46(12)
Other superiors in company/ agency besides immediate superior	30(3)	25(4)	27(7)
An immediate superior	30(3)	25(4)	27(7)
Individuals at lower levels in company/agency who are not immediate subordinates	20(2)	31(5)	27(7)
Immediate subordinates	10(1)	13(2)	12(3)

reducing communication overload could perhaps be significant motivating forces for video conferencing. Finally, less than one-half of the meetings in either public (40%) or private (38%) sectors involved a direct vertical superior/subordinate dyad at opposite ends of the channel. Nevertheless, the proportion of meetings in which such a link appeared is greater than is implied by the individual statistics. Given the important effects that the presence of direct hierarchical reporting relationships can have on interaction processes in meetings, a finding that 40% of the meetings included at least one such relationship is far from inconsequential, even in relation to the more common presence of the other forms of linkage.

Communication activities

Following Pye et al,[21] and Noll,[22] respondents were asked to rate the amount of time that was devoted to each of several communication activities during the teleconference.[23] The primary purpose of these self-reports was less to obtain accurate time estimates than to determine which types of communication activities tended to dominate the conferences, and, conversely, which activities rarely occurred. Obviously, the data obtained can provide only a broad brush sketch, since different individuals are likely to perceive the same interchange differently from each other and differently from an outside observer.

Early studies of interactive video conferencing suggest that the medium is best suited for information exchange activities, in contrast to communication activities involving interpersonal conflict, bargaining, or negotiation.[24] As shown in Table 14, the survey results confirm the prevalence of information exchange activities. However, the meetings involved significant amounts of a variety of other communication activities: presentations, progress checks, discussions of documents, budget or plan reviews, coordination, brainstorming, project planning, advice giving, and problem solving. This diversity of communication activities suggests that current video conferencing technology is flexible and able to satisfy a variety of communication needs. Less frequently reported activities include interviewing candidates, negotiating, delegating tasks, instructing, conversing socially, persuading, and resolving disagreements. However, the latter three activities were reported as receiving at least minimal attention by nearly half of the respondents.

The literature on teleconferencing suggests that individuals may prefer to handle negotiation or persuasion in face-to-face groups, perhaps because such activities require 'high personality involvement',[26] a greater degree of 'social presence',[27] or greater 'propinquity'.[28] In some respects, the responses of our sample of users reinforce this view; respondents reported that little time was spent on persuading and negotiating. At the same time, however, these activities are less common in most formal meetings than is simple information exchange.

The communication activities in Table 14 have been arranged according to the broad communication tasks they appear to support: surveillance, socialization, or control,[29] or entertainment.[30] Clearly, the activities within a category are not exhaustive. Superimposition of this broad frame, however, highlights the extant focus of two-way video and audio conferencing on two categories in particular: surveillance and consensus. The survey results suggest that interactive video was, indeed, primarily a tool for surveillance and consensus building. Some form of

[21]Roger Pye, Brian Champness, Hugh Collin, and Stephen Connell, *The Description and Classification of Meetings*, Communications Studies Group, University College, London, 1973, Ref P/73160/PY.

[22]A. Michael Noll, 'Teleconferencing communications activities', *Proceedings of the Institute of Electrical and Electronics Engineers*, 1977, pp 8–14.

[23]Previous studies of meeting activities, however, used different measures.

[24]B.G. Champness, *The Assessment of Users' Reactions to Confravision: II Analysis and Conclusions*, Communications Studies Group, University College, London, 1973, Report E/73250/CH; Noll, *op cit*, Ref 22.

[25]*Ibid.*

[26]Noll, *op cit*, Ref 22.

[27]John Short, Ederyn Williams and Bruce Christie, *The Social Psychology of Telecommunications*, John Wiley and Sons, New York, 1976.

[28]Felipe Korzenny and Connie Bauer, 'Testing the theory of electronic propinquinity', *Communication Research*, Vol 8, No 4, pp 479–498.

[29]Harold D. Lasswell, 'The structure and function of communications in a society', in *The Communication of Ideas*, ed Lyman Bryson, Institute for Religious and Social Studies, New York, 1948.

[30]Wilbur Schramm, 'The nature of communication between humans' in *The Process and Effects of Mass Communication*, ed Wilbur Schramm and Donald Roberts, revised edition, University of Illinois Press, Urbana, IL, 1971.

Table 14. Time devoted to communication tasks and activities.[a]

Communication tasks and activity[b]	1 No time spent, % (N)	2 Little time spent, % (N)	3 Moderate time spent, % (N)	4 Much time spent, % (N)	Total % (N)	Rank, mean[c]
Task A. Surveillance (sharing knowledge of environment)						
Exchanging information	2(1)	6(4)	38(26)	54(37)	100(68)	3.4
Exchanging opinions	8(5)	18(12)	36(24)	39(26)	100(67)	3.0
Giving presentations or reports	21(14)	22(15)	29(20)	28(19)	100(68)	2.6
Brainstorming/generating ideas	43(29)	21(14)	27(18)	9(6)	100(67)	2.0
Giving advice or assistance	34(23)	39(26)	18(12)	9(6)	100(67)	2.0
Task B. Socialization						
Instructing or teaching	73(48)	20(13)	8(5)	0(0)	100(66)	1.3
Interviewing candidates for jobs, promotions, transfers	95(62)	0(0)	2(1)	3(2)	100(65)	1.1
Task C. Entertainment						
Social conversation	54(37)	44(30)	2(1)	0(0)	100(68)	1.5
Task D. Consensus (gain consensus, persuade, control)						
Monitoring performance or checking progress	39(26)	21(14)	21(14)	18(12)	100(66)	2.2
Discussing documents	28(19)	37(25)	25(17)	9(6)	100(67)	2.1
Appraising or reviewing plans or budgets	41(27)	23(15)	21(14)	18(12)	100(66)	2.1
Coordinating activities	38(26)	32(22)	15(10)	15(10)	100(68)	2.0
Planning a future event, project, or activity	39(26)	33(22)	21(14)	8(5)	100(67)	2.0
Solving a problem	37(25)	37(25)	19(13)	6(4)	100(67)	1.9
Resolving a disagreement	52(35)	21(14)	19(13)	8(5)	100(67)	1.8
Persuading	51(34)	32(21)	14(9)	3(2)	100(66)	1.7
Delegating tasks	77(51)	15(10)	6(4)	2(1)	100(66)	1.3
Negotiating an agreement	75(50)	21(14)	5(3)	0(0)	100(67)	1.3

[a]Respondents were asked: 'During the video conference you just completed, how much time was devoted to each of the following kinds of communications activities?'; [b]task categories are based on those of Harold D. Lasswell, 'The structure and function of communications in a society', *The Communication of Ideas*, ed Lyman Bryson, Institute for Religious and Social Studies, New York, 1948; and Wilbur Schramm, 'The nature of communication between humans', ed Wilbur Schramm and Donald Roberts, revised edition, University of Illinois Press, IL, 1971; [c]the mean was calculated using a scale where 1 equalled 'No time spent' and 4 equalled 'Much time spent'.

surveillance activity was reported by nearly all respondents; and over one-half of the respondents perceived at least some time being spent on each surveillance activity. While not as pervasive as surveillance, consensus activities also tended to be a common feature of video conferencing.

The dominance of surveillance, the prevalence of more subtle as opposed to more blatant consensus building activities (discussing a document versus persuading), and the relative lack of socialization activities might reflect the relatively equal status of conference participants across nodes that was described earlier.

An additional analysis involved clustering the responses according to meeting, for both public and private sector conferences. The results were virtually identical to the aggregated individual responses, due to a substantial amount of agreement across participants of each meeting. The results were also highly similar in public and private sector meetings, with only two exceptions. Significantly more time was spent in public sector meetings on problem-solving (public $\bar{X} = 2.1$, private $\bar{X} = 1.5$; difference $p < 0.05$) and resolving disagreements (public $\bar{X} = 2.2$, private $\bar{X} = 1.3$; difference $p < 0.05$) The variances were also similar; those activities with the greatest variability of time spent across meetings continued to be: giving presentations, brainstorming, performance monitoring, appraising or reviewing plans or budgets, and exchanging opinions.

A final analysis involved investigating whether participants' prior experience with the medium was related to the amount of time spent on

various communication tasks in the meeting. Experienced participants might be expected to employ it for a broader range of more complex activities, and to trust it more for tasks that most individuals prefer to accomplish in face-to-face interaction. In general, facility with the medium may abet its usage for a broader array of communication needs, particularly those requiring higher interpersonal involvement.

The findings presented in Table 15 provide some support for this expectation. No significant relationships were found between the number of previous video conferences and those activities typically regarded as requiring low interpersonal involvement. However, high interpersonal involvement activities such as negotiating, delegating, and resolving disagreements are all significantly related to prior experience. In addition, coordinating and monitoring performance, arguably more complex activities, also are significantly related to prior experience. The correlations for persuading and problem-solving, often thought of as 'high bandwidth', are also in the expected direction, although are not significant.

Summary and conclusion

The survey findings suggest a number of conclusions concerning usage patterns. However, these must be viewed cautiously due to the brief timeframe of the study, the small sample sizes, and the limited focus on one publicly available system. Future in-depth research should be conducted to verify these results across a diverse set of users and video conferencing systems, at varying rate structures.

Organizations from a variety of industries in both profit and non-profit sectors are employing this medium for organizational and interorganizational communications. Additionally, these organizations vary among themselves in both size and degree of geographical dispersion. Among this disparate group, somewhat more frequent usage is made by larger organizations and by companies within the telecommunications, insurance, and health services industries. The picture that emerges is one of both great diversity and yet some degree of concentration.

Table 15. Relationship of prior participant experience to time devoted to various communication tasks and activities in a meeting.[a]

Communication tasks	Zero order correlation
Task A. Surveillance	
Exchanging information	0.14
Exchanging opinions	0.04
Giving presentations or reports	–0.17
Brainstorming/generating ideas	0.07
Giving advice or assistance	0.03
Task B. Socialization	
Instructing or teaching	–0.11
Interviewing candidates for jobs, promotions, transfers	–0.07
Task C. Entertainment	
Social conversation	–0.21
Task D. Consensus	
Monitoring performance or checking progress	0.41[b]
Discussing documents	0.18
Appraising/reviewing plans or budgets	–0.19
Coordinating activities	0.47[b]
Planning a future event, project, or activity	0.04
Solving a problem	0.26
Resolving a disagreement	0.48[b]
Persuading	0.36
Delegating tasks	0.65[b]
Negotiating an agreement	0.45[b]

[a]Based on 26 meetings. Correlations are between the average experience level reported in a meeting and the average amount of time devoted to a communication activity; [b]$P < 0.05$.

A similar conclusion derives from the analysis of intraorganizational users. Video conferencing is employed by individuals from a host of different functional areas, organizational levels, and unit sizes. Our results suggest more diversity than is projected by the stereotype of video teleconferencing as a tool of organizational elites. At the same time, however, the more frequent usage by top management and by individuals in the marketing function suggests that certain organizational substrata may be taking greater advantage of the system to date. Thus, one could hardly argue the other extreme position that video conferencing is a 'citizen technology' that is equally utilized by all economic sectors and hierarchical strata.

Video teleconferencing tends to be used interactively; that is, most individuals actually assume the role of discussant rather than primarily of speaker, or simply of listener. This is not surprising, given the marked lack of direct hierarchical relationships across nodes. In fact, the majority of links were interorganizational, where hierarchical roles would not apply well. The strong presence of interorganizational links suggests the prevalent usage of video conferencing for maintaining important links to the organization's environment. This finding is also consistent with the somewhat more frequent usage of video conferencing by top management and marketing personnel. Top management tends to orient a great deal of its activity towards management of important environmental contingencies for the organization,[31] and marketing is a major 'boundary-spanning' unit which conducts significant activity with customers and clients outside the organization. Among intraorganizational links, the most common were horizontal and diagonal. Such links reflect direct contact between managers who are interdependent but who report to different managers, and thus cannot directly coordinate their activities through a common superior. Such direct contact can contribute to organizational efficiency by reducing managerial frustration and avoiding the communication overload which may occur when common problems and/or coordination needs are referred ever upward until that point at which they reach a common superior to the individuals involved.[32] Thus, video conferencing's use for horizontal and diagonal communication can have important resource-saving functions. The frequency with which such non-hierarchical links occurred suggests that the medium may be well suited to such integration functions.

Video conferencing is most commonly used for information and opinion exchange, what is generally classified as surveillance. Also, a variety of consensus-building activities that involve group decision making were reported by respondents. This pattern probably reflects the relatively equal status of participants across nodes. Support for the reluctance to use teleconferencing for highly interpersonal activities like negotiations and persuading is found here. However, the utilization of video teleconferencing for several more highly 'personally involving' tasks did relate positively to experience with the medium. This suggests that the medium has greater potential for involving a broad range of communication activities than the overall findings would suggest. In general, the diversity of communication activities engaged in over this medium suggests caution in attempting to characterize communication in a typical video conference.

Interpretation of these findings is confounded by the difficulty of separating the medium and technology from their context. That is, video

[31]Henry Mintzberg, *The Nature of Managerial Work*, Harper and Row, New York, 1973.
[32]Galbraith, *op cit*, Ref 20.

conferencing often requires many changes in factors not specifically medium-related. For example, there may be more careful preplanning of meetings, fewer (if any) interruptions for participants to receive telephone calls or attend to other non-meeting demands, more careful attention to the amount of time being spent in the meeting, specified beginning and ending times, and the like. Also, the fact that the meetings are held off-premises may affect the meeting process, since no individual participant would have the upper hand by being on his/her own 'turf'. These and other contextual factors may have important effects on video meetings regardless of the medium effects. Clearly, experimental studies designed to separate out the effects of medium and context represent a useful research direction.

In conclusion, characterization of a typical video conference is generally difficult. Linkages are horizontal, diagonal, or vertical, and nodes may be within or across organizations. Few respondents were frequent users, and most organizations were not regular video conferencing users. The most consistent characterization is that the conferences included many individuals who would not otherwise have attended the meeting and that most participants took advantage of the interactive nature of the medium by acting in a discussant capacity. Given the group composition, interactive nature of the communication, and the decision making relevance of many of the communication activities, video telecommunications is likely to satisfy a variety of communication needs related to decision making processes in modern organizations.